

Ministry of Education and Science of Ukraine  
National University of Water and Environmental Engineering  
Department of Architectural Design Bases, Construction and Graphics

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## **METHODICAL GUIDELINES**

and tasks to a practical training and independent work

*IN THE DISCIPLINE*

*«DESCRIPTIVE GEOMETRY»*

### **PART 2. SHADOWS IN ORTHOGONAL PROJECTIONS**

for higher education students of the first (bachelor) level  
in the field of study 191 «Architecture and Urban planning»  
of full-time education form

## **МЕТОДИЧНІ ВКАЗІВКИ**

та завдання до практичних занять і самостійної роботи

*З НАВЧАЛЬНОЇ ДИСЦИПЛІНИ*

*«НАРИСНА ГЕОМЕТРІЯ»*

### **ЧАСТИНА 2. ТІНІ В ОРТОГОНАЛЬНИХ ПРОЕКЦІЯХ**

для здобувачів вищої освіти першого (бакалаврського) рівня  
за спеціальністю 191 «Архітектура та містобудування»  
денної форми навчання

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Methodical guidelines and tasks to a practical training and independent work in the discipline «Descriptive Geometry» for higher education students of the first (bachelor) level in the field of study 191 «Architecture and Urban planning» of full-time education form. Part 2. Shadows in orthogonal projections [Electronic publishing] / Pugachov E. V., Litnitskyi S. I., Kundrat T. M. – Rivne : NUWEE, 2023. – 18 p.

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## INTRODUCTION

Methodical guidelines and tasks to a practical training and independent work are developed according to the syllabus of the course for higher education students of the first (bachelor) level in the field of study 191 “Architecture and Urban planning” of full-time education form.

The purpose of practical classes is to consolidate theoretical knowledge, acquire skills in building shadows on architectural forms, as well as develop spatial imagination by comparing geometric objects in three-dimensional space and their images on a plane.

Methodical guidelines contain questions for independent training, tasks and exercises and short methodical guidelines.

All tasks are performed in pencil on A3 format. Basic data and results are allocated with the reinforced line. Auxiliary constructions show the thin line a firm pencil. Results of the carried-out tasks serve for control of the current progress and admission to examinations.

## 1. QUESTIONS FOR INDEPENDENT TRAINING

1. What is the purpose of building shadows on architectural objects?
2. Why at creation of shadows from the sun rays of light are parallel among themselves?
3. Explain the term "own shadow" and "own shadow contour".
4. Explain the term "falling shadow from a point on a plane".
5. A projection of which geometric object is a falling shadow?
6. What direction do light rays (the "standard" direction) have?
7. Explain the term "imaginary shadow from a point". Why it is used?
8. What properties have shadows from straight lines of special situation (the perpendicular and parallel plane, horizontal, located at an angle  $45^\circ$  to the frontal plane)?
9. What property does the shadow from a flat figure falling on the plane parallel to it have?
10. Explain how an own shadow is built on a circular vertical cylinder? A shadow falling from him?
11. Explain how the falling and own shadow is formed from a straight circular cone, which is located with the top up? Which is located top down?
12. Call the geometrical figures formed by a contour of own and falling on the plane sphere shadow.
13. Explain the essence of the method of constructing own shadows on surfaces of revolution using tangent cones and cylinders.
14. Explain essence of a way of the return rays. In what cases is it used?
15. In what does the essence of a way of "carrying out" consist? In what cases is it used?
16. Explain essence of a way of the auxiliary intermediary planes. Field of its application.
17. In what cases the way of auxiliary design is used? In what its essence?
18. Explain in which cases the Pille plane is used to construct shadows? What is the essence of this method?

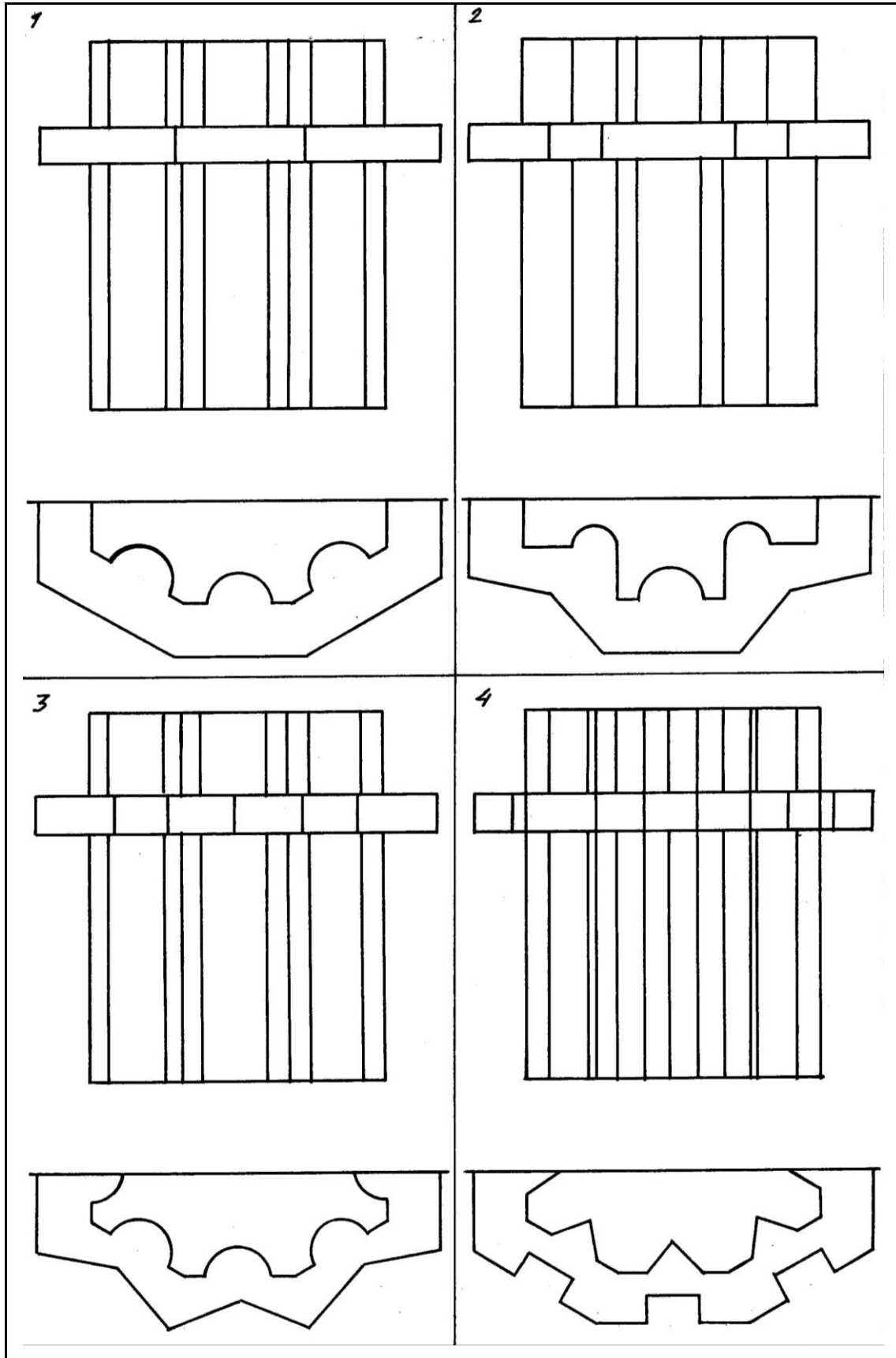
**Literature:** 1 (pp. 129-138), 2 (pp. 75, 87-90, 131, 132), 3 (pp. 141-190), 4 (pp. 82-85, 90-94), 5 (pp. 162-216), 6 (pp. 198-218), 7 (pp. 110-170).

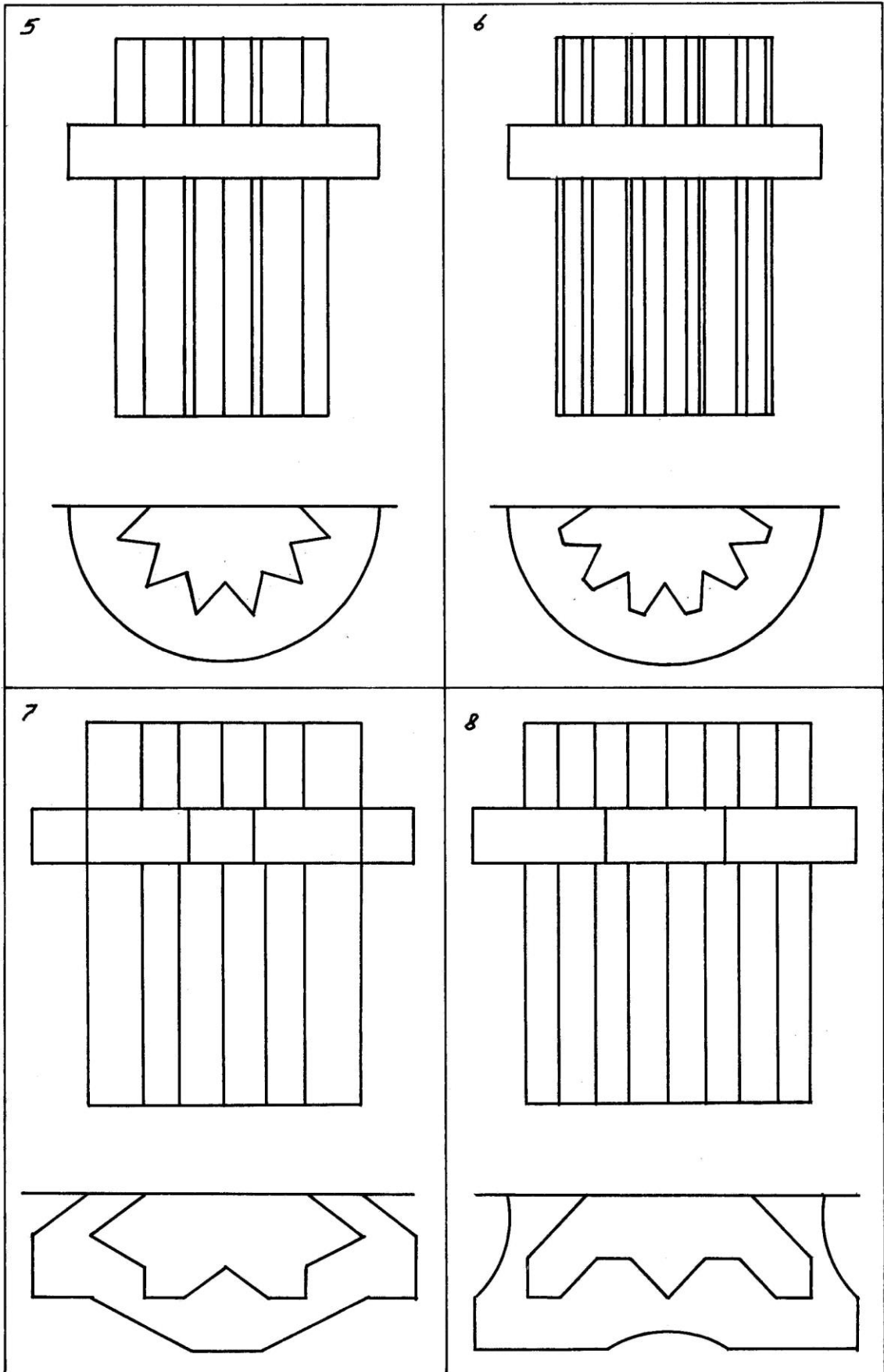
## 2. SHADOWS OF SIMPLE FORMS

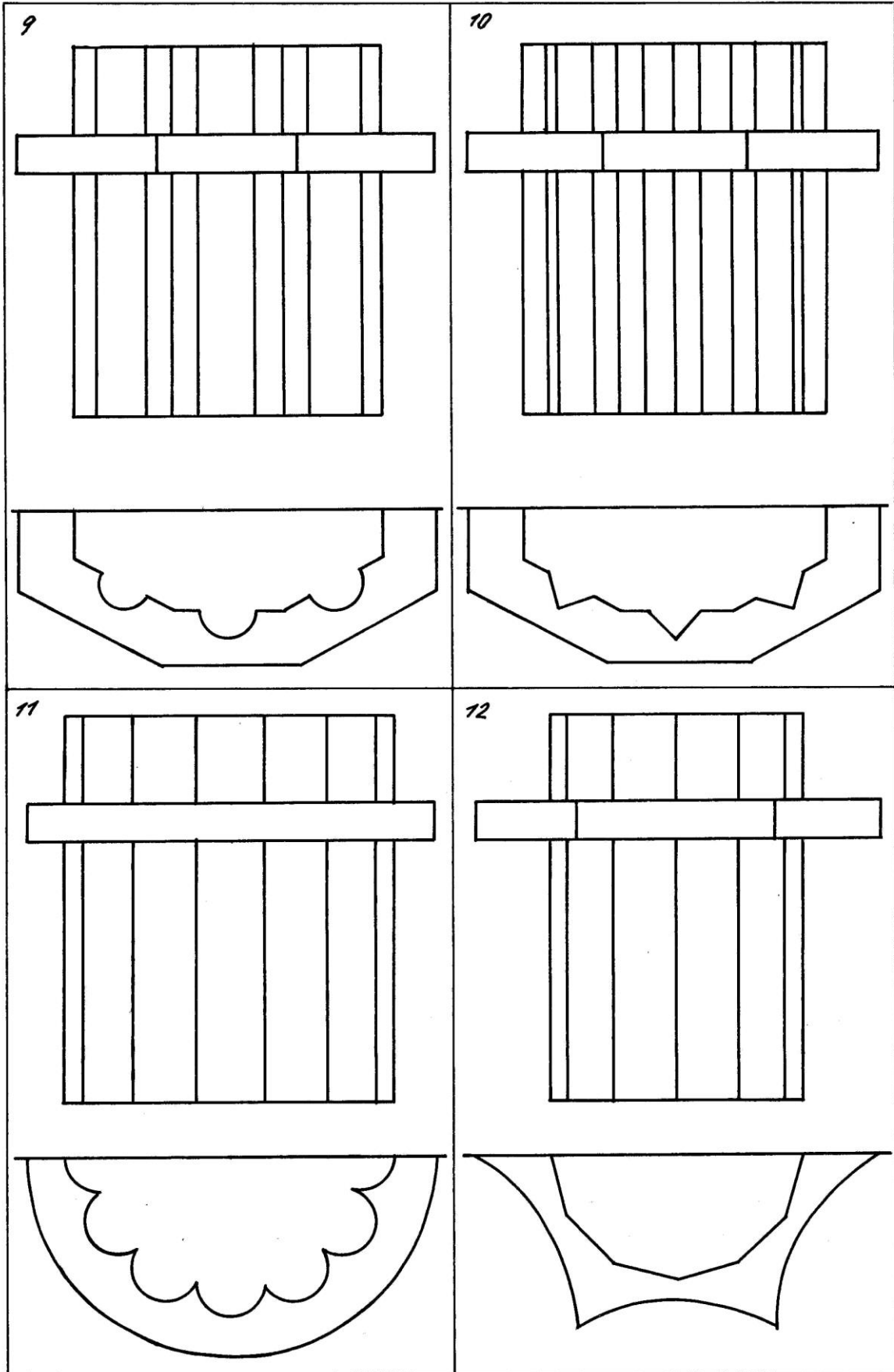
**Task:** to construct own and falling shadows.

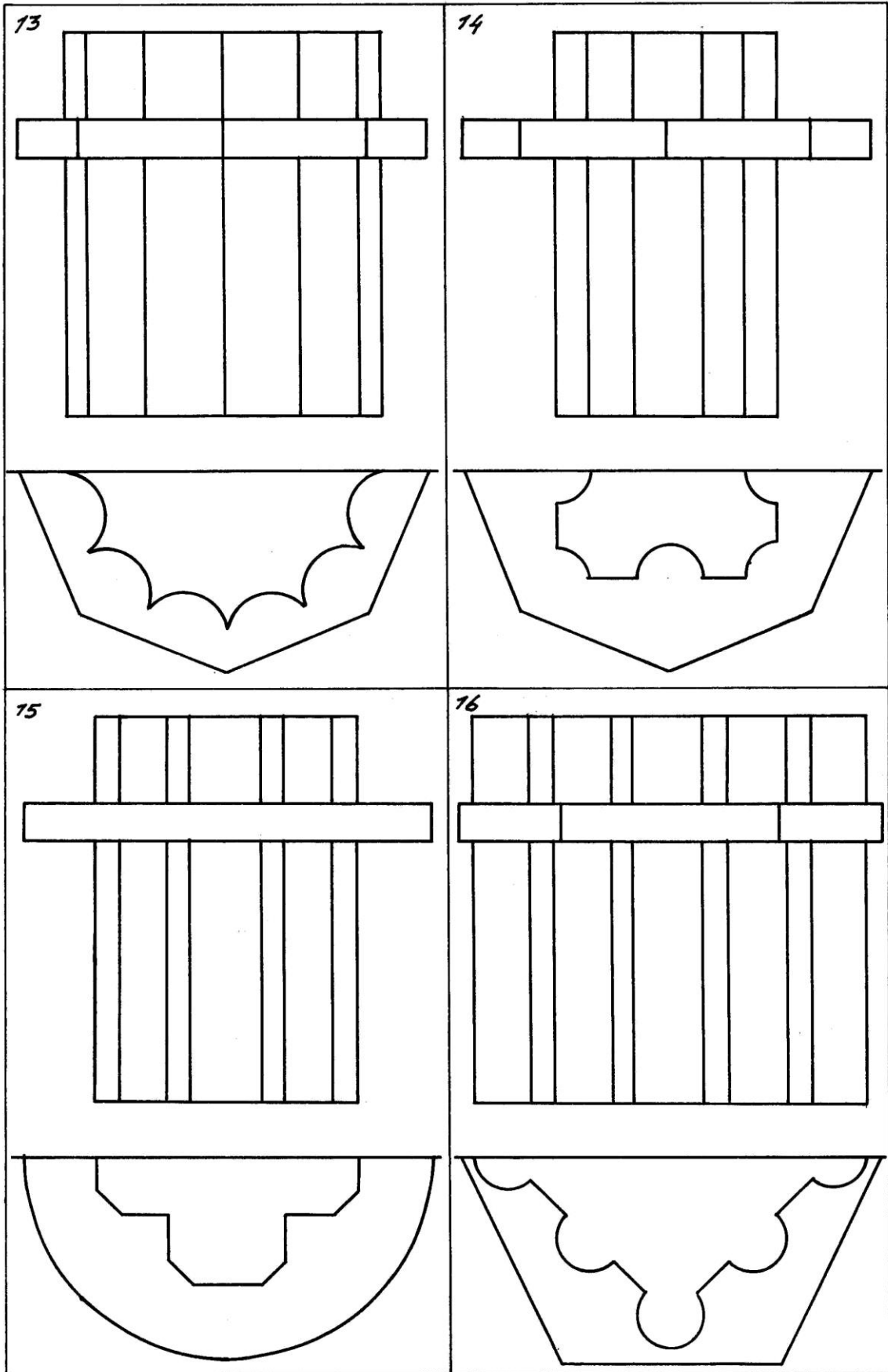
Basic data are given in table 1.

Table 1

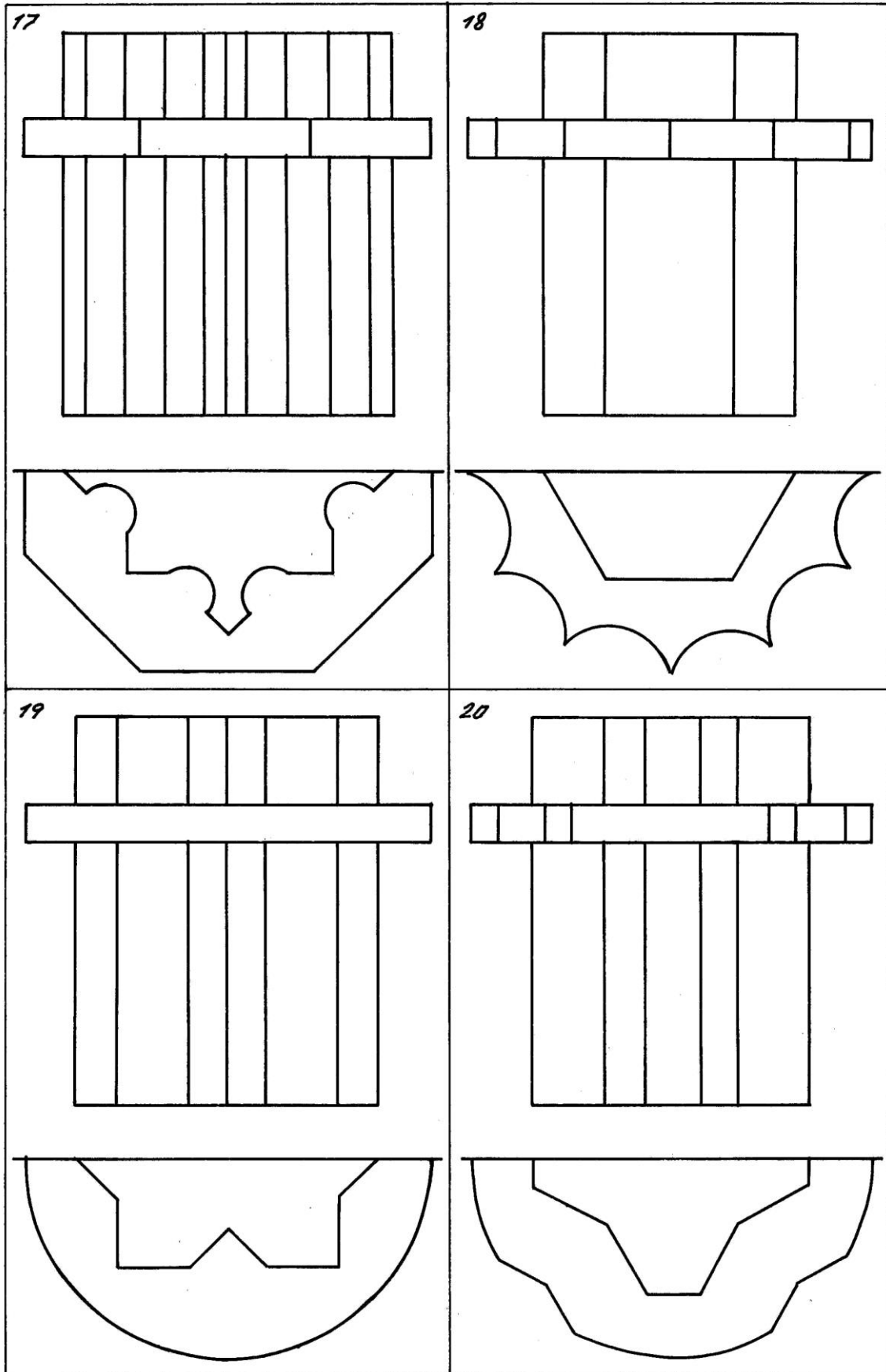


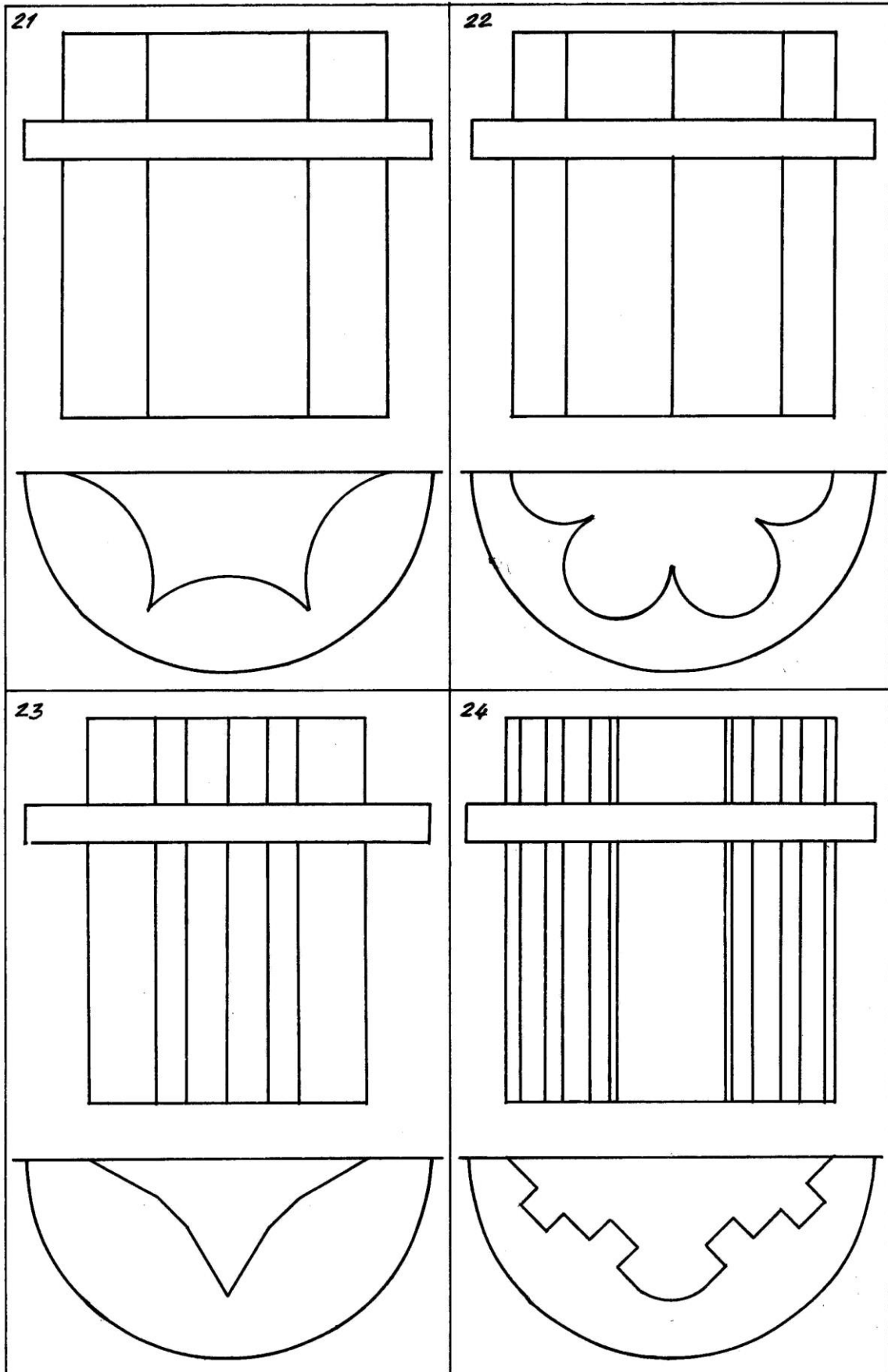


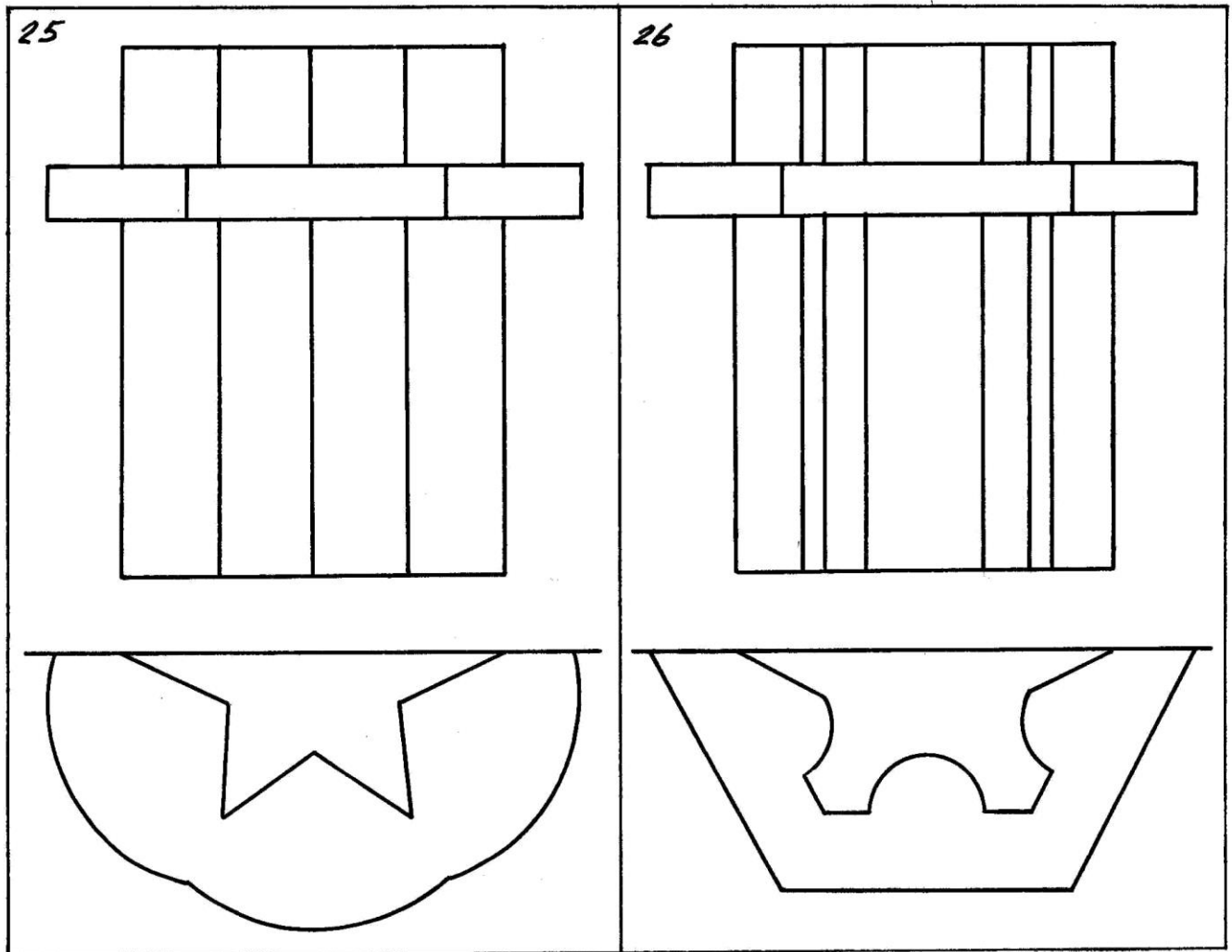












**Methodical guidelines:** *a)* for creation of points of a break of the shadow falling from eaves on edges of a prismatic part of a geometrical object it is necessary to use way of the return rays (on the plan there is an eaves point from which the shadow on an edge falls); *b)* if the eaves is a section of the surface of the torus, then its own shadow is built on it with the help of tangent cones and cylinder; *c)* it is also necessary to construct a shadow falling from the base of the prismatic part on the frontal plane; *d)* do not erase auxiliary constructions with a firm pencil, but show the shadow with hatching under the ruler.

**Literature:** 2 (p. 87), 5 (pp. 162-216).

### 3. SHADOWS OF EAVES AND BRACKETS

**Task:** to construct own and falling shadows.

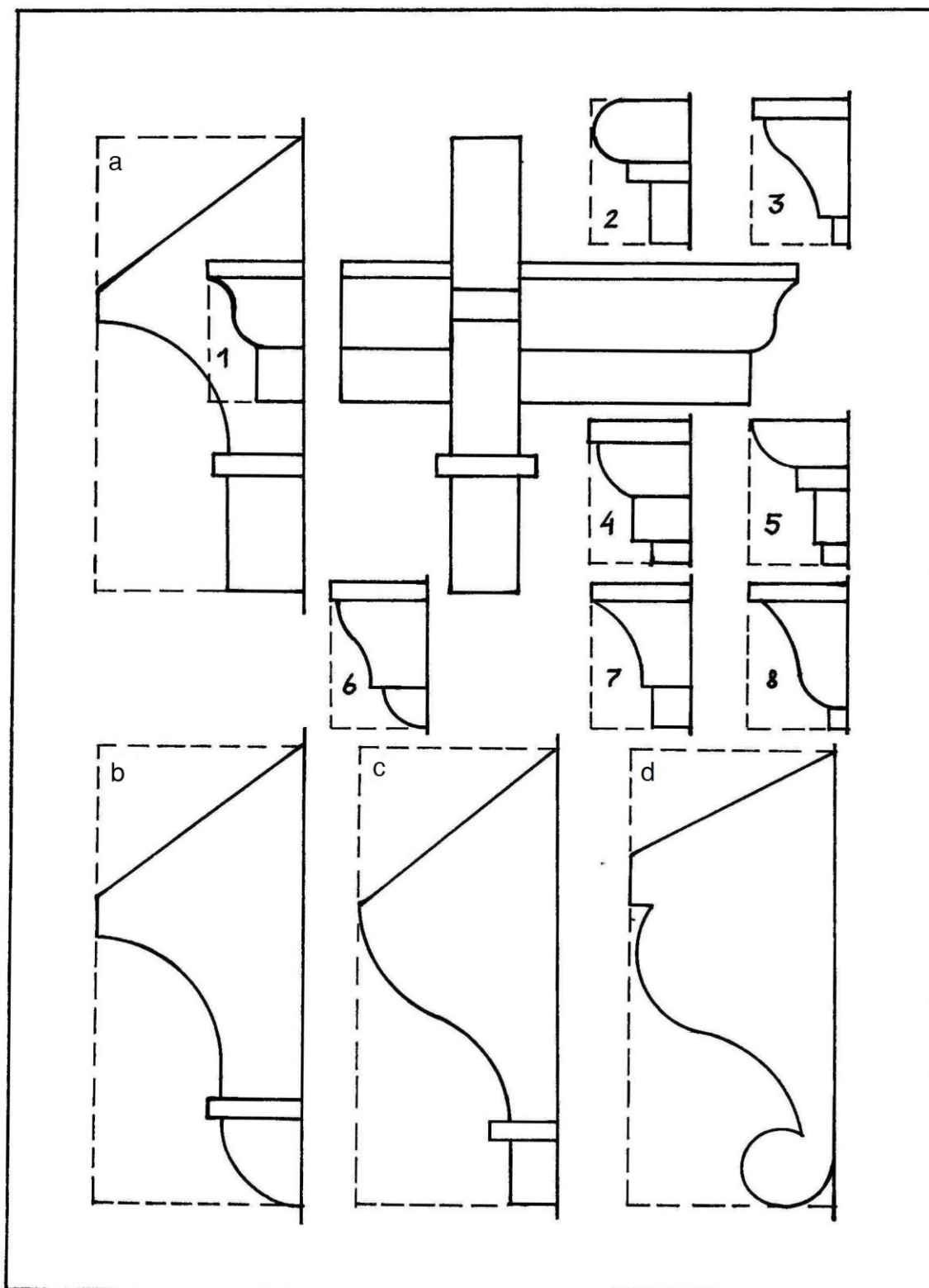
Basic data are given in tables 2 and 3.

Table 2

Task	Eaves	Bracket	Task	Eaves	Bracket
1	1	a	14	6	a
2	2	b	15	7	b
3	3	c	16	8	c
4	4	d	17	1	a
5	5	b	18	2	b
6	6	c	19	3	c
7	7	d	20	4	d
8	8	a	21	5	b
9	1	c	22	6	c
10	2	d	23	7	d
11	3	a	24	8	a
12	4	b	25	1	b
13	5	d			

**Methodical guidelines:** *a)* the mutual placement of the bracket and the eaves should be approximately as shown for one of the possible combinations in the table. 3; *b)* the left profile of the eaves gives a shadow falling on it; *c)* the overhung parts of the bracket give falling shadows on its surface; *d)* the shadow from the bracket, falling on the eaves, breaks on it, and for its construction it is necessary to use the method of the return rays; *e)* assume that the right profile of the eaves lies in a horizontally projecting plane that forms an angle of 45° with the frontal plane.

**Literature:** 2 (pp. 87,88), 3 (p. 166), 5 (pp. 162-216), 7 (pp. 128, 129).

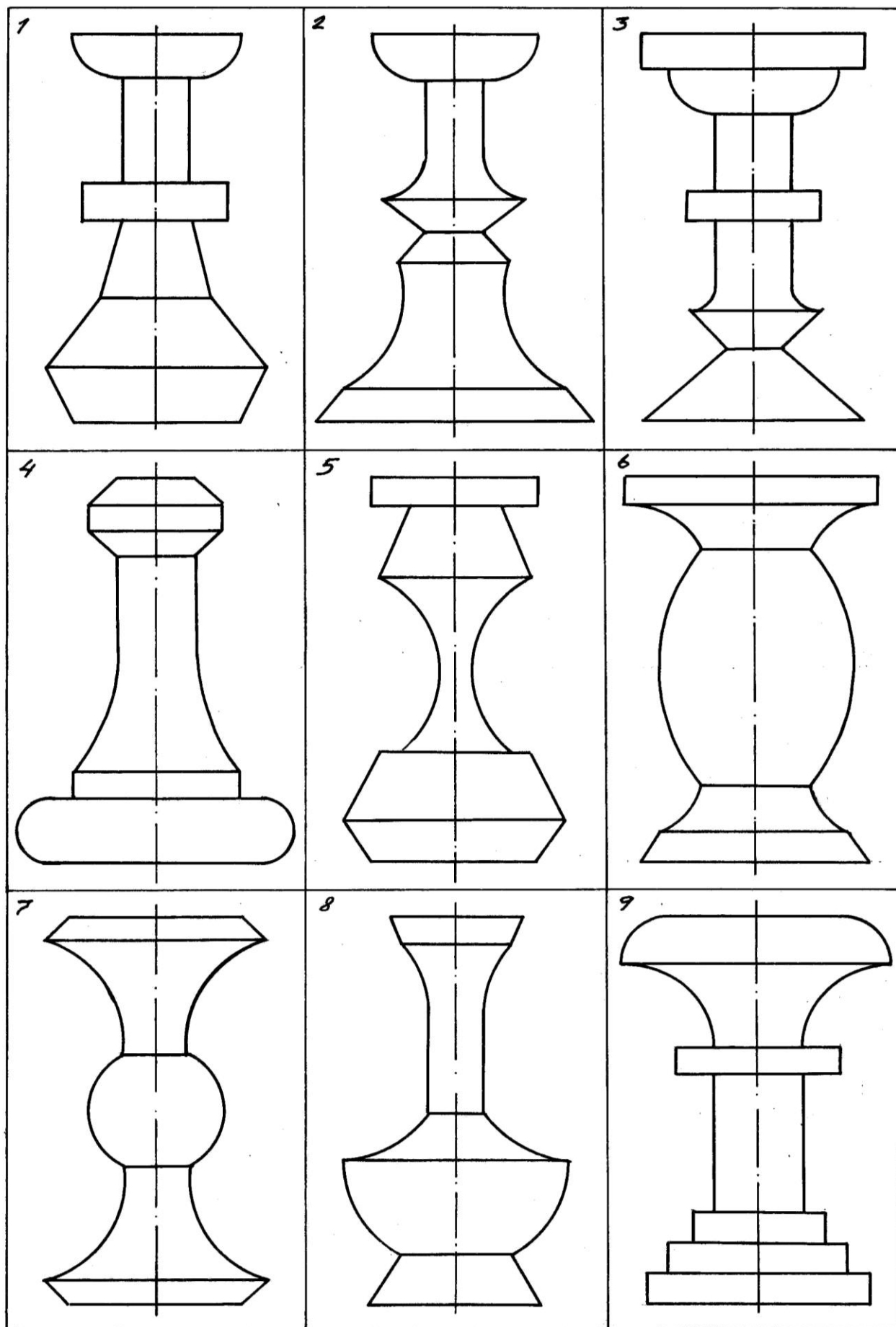


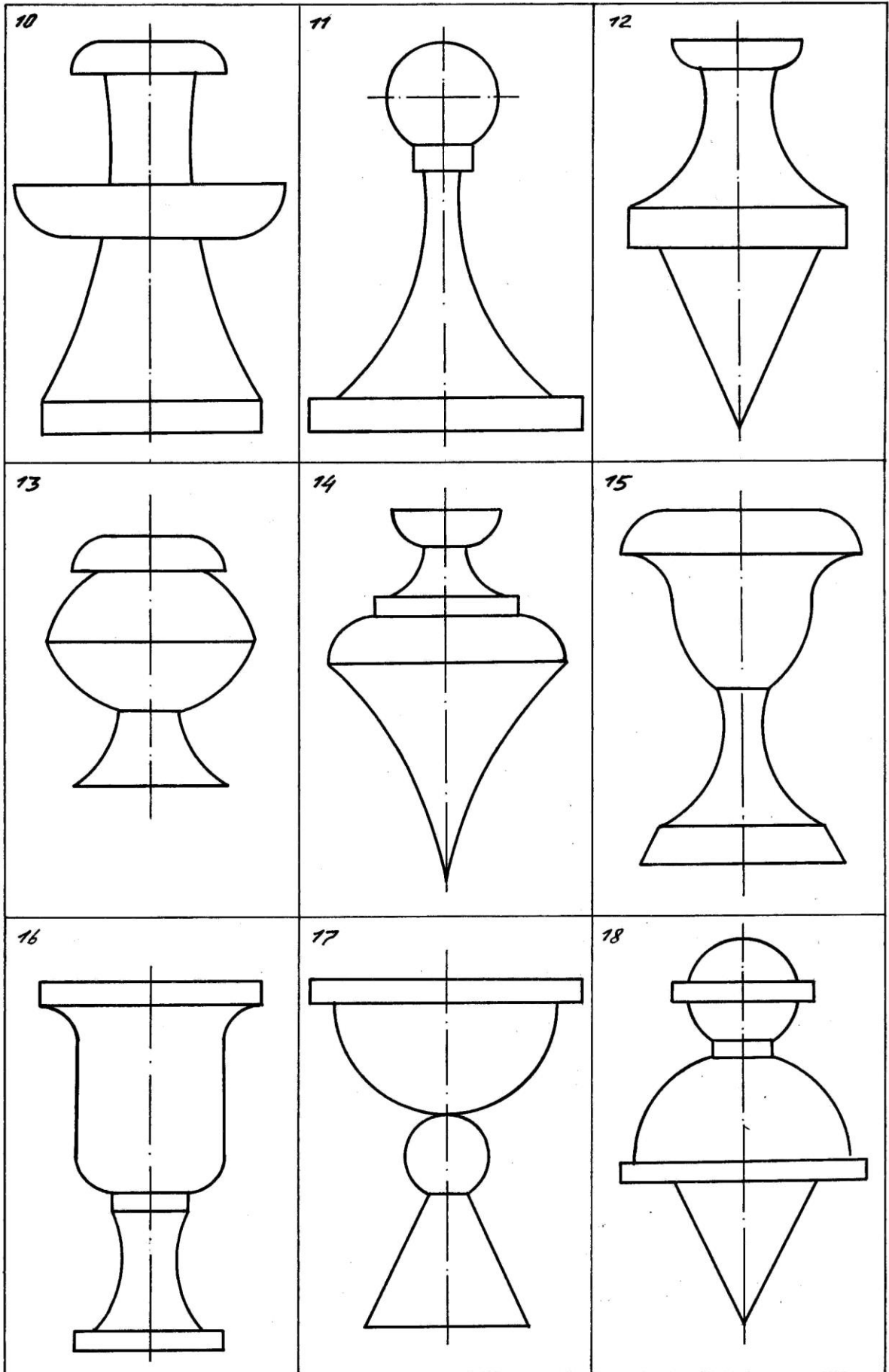
#### 4. SHADOWS OF ROTATION BODIES WITH A VERTICAL AXIS

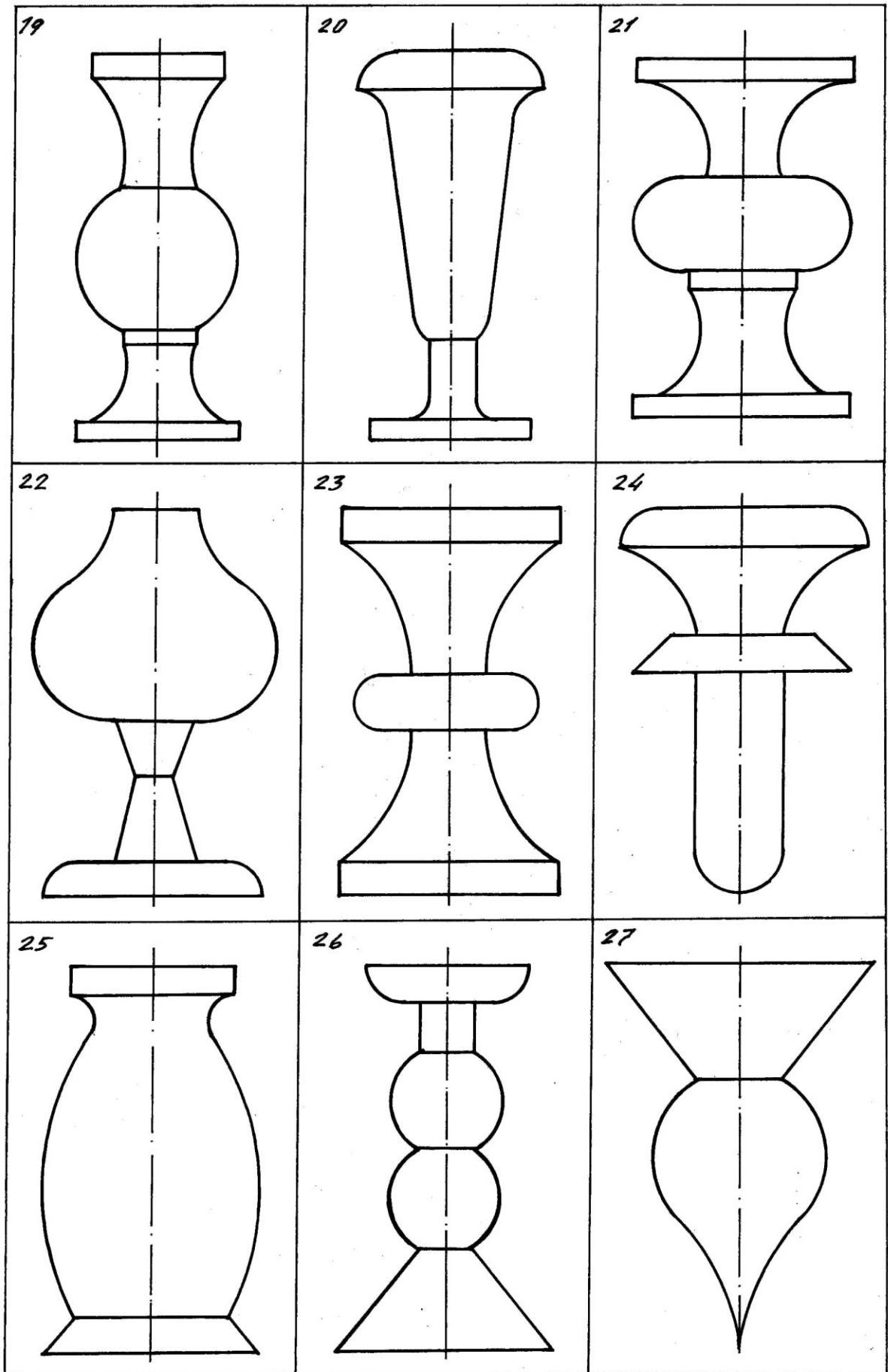
**Task:** construct own shadows and those falling on the frontal plane, considering that the body of rotation protrudes halfway from the frontal plane.

Basic data are given in table 4.

Table 4









**Methodical guidelines:** *a)* at first it is necessary to construct own shadow using the method of tangent cones and cylinders; *b)* then it is necessary to construct the shadow falling on the frontal plane from a contour of own shadow; *c)* further the shadow falling from a contour of own shadow on the body of rotation is under construction for what use the Pelle plane; *d)* the shadow falling on the rotating body will begin at the points of intersection of the contours of the body with the contour of the shadow falling on the frontal plane (break points of the shadow contour).

**Literature:** 1 (p. 191), 2 (pp. 88, 89), 3 (pp. 148-161, 168-175), 4 (pp. 88, 89), 5 (pp. 162-216), 6 (pp. 207-215), 7 (pp. 142-157).

## 5. LITERATURE

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### Information resources

1. National Library named after V. I. Vernadskyi. URL: <http://www.nbuv.gov.ua/>

2. Rivne Regional Universal Scientific Library (Rivne, Maidan Korolenko, 6). URL: <http://www.lib.rv.ua/>

3. Scientific library of NUWEE (Rivne, st. Oleksy Novaka, 75). URL: <http://nuwm.edu.ua/naukova-biblioteka>

4. Digital repository of NUWEE. URL: <http://ep3.nuwm.edu.ua/view/types/metods/>